

REMARKS

I. Status of the Claims

Claims 1-19 are all the claims pending in the application.

Applicant herein adds claims 20-22. No new matter has been added.

II. Objections to the Specification

The Examiner objects to an informality in the disclosure. Specifically, page 26 line 25 refers to “FIGURE 18.” The Examiner asserts that the reference should be directed to FIGURE 9 instead of “FIGURE 18.” Applicant herein amends the specification accordingly.

Additionally, Applicant herein amends the paragraph bridging pages 39 and 40. Specifically, the phrase “optical fiber 251,” on line 1 of page 40 is herein amended to read “optical fiber 251 comprising the core 251a and cladding 251b.”

III. Claim Rejections under 35 U.S.C. § 103

Claims 1-15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Craig et al. (U.S. Patent No. 5,761,234, “Craig” hereinafter) in view of Andrews (U.S. Patent No. 5,640,188; “Andrews ‘188” hereinafter), and further in view of Andrews et al. (U.S. Patent No. 5,432,535; “Andrews ‘535” hereinafter) and Kuniyasu et al. (U.S. 2002/0018499; “Kuniyasu” hereinafter).

Claims 16-19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Craig in view of Andrews ‘188, and further in view of Kuniyasu and Hwang (U.S. Patent No. 5,337,325).

Applicant respectfully traverses these rejections.

Independent claims 1 and 16-19 require laser and submount relationships in accordance with a bonding surface, such that the bonding surface is provided as a metallization layer and an Au-Sn solder layer, each of which is divided into plural areas. Kuniyasu, on the other hand discloses a metallization layer 231 which comprises a continuous formed element. See Kuniyasu, Fig. 32.

The Examiner contends that Kuniyasu (Fig. 32, elements 258, 231) teaches the relation of the metallization and solder layers. However, since the purported metallization layer 231 comprises a continuous formed element, it cannot correspond to a layer divided into a plurality of areas, as claim 1 requires. As such, Applicant submits that the applied references fail to disclose all of the features of claim 1.

Furthermore, Applicant notes that Kuniyasu discloses cooling of a GaN semiconductor laser, which has a poor electrical-optical energy conversion efficiency compared to infrared lasers, to suppress deterioration of the properties thereof. The present invention, by contrast, does not bond the light emitting portions of lasers, since such an arrangement would cause more heat to be generated, and would make heat dissipation more difficult. These two concepts are obviously in conflict with each other. Therefore, one skilled in the art would not easily arrive at the structure of the present invention based on the teaching of Kuniyasu.

In addition, Applicant notes that in order to efficiently multiplex laser beams, it is necessary to regulate the accuracy of light emitting positions to within $\pm 1 \mu\text{m}$. In addition,

because the accuracy of light emitting positions set by mounting deteriorates by an order of 10 compared to those set by lithography, it is common to employ a laser bar, such as disclosed in the Craig reference. Since the present invention, by contrast, arranges the elements along a line, one skilled in the art would not easily arrive at the structure of the present invention.

Also, Applicant notes that the Examiner has not addressed all of the requirements of Applicant's claimed invention. In particular, the Examiner has not cited any reference that either teaches or suggests use of a submount made from a material with a thermal expansion coefficient of 3.5 to $6.0 \times 10^{-6}/^{\circ}\text{C}$, as claimed in claims 1, and 16-19. Indeed, none of the references cited by the Examiner make any mention of the importance of the thermal expansion coefficient of the material used to manufacture the laser submount. Therefore, Applicant respectfully submits that the Examiner has not made a *prima facie* case of obviousness sufficient to support a 35 U.S.C. § 103(a) obviousness rejection.

Still further, Applicant notes that the region denoted 273 in Fig. 82 of Kuniyasu, solder is not divided, in order to prevent cooling media therein from leaking out. It is assumed that the pattern of solder is a frame shape, that is, with no solder in the central portion. However, when the amount of heat generated by a laser is small, and thermal expansion of a laser submount is a concern, generally, a light emitting portion is not bonded to the laser submount, but rather mounted via a junction. Whereas, when the amount of heat generated by a laser is large, thermal strain and deterioration in properties due to temperature increase at a light emitting portion are conspicuous, if the light emitting portion, at which the most heat is generated, is not bonded. Therefore, generally, the laser is mounted such that the entire surface of the light emitting

portion is bonded to a material having a thermal expansion coefficient as close as possible to that of the laser. It has been reported in the prior art that the relationship between the coefficients of thermal expansion of a semiconductor laser and a laser submount influence the properties of the laser, as this structure is thought to deteriorate thermal conduction. As a result, a structure in which solder and the like are divided and the light emitting portions are partially bonded, as in the present invention, has not been considered. Thus, the structure of the present invention, in which solder is divided and partially bonded in order to arrange GaN semiconductor lasers in an array with high positional accuracy, represents an important distinction over the prior art.

Therefore, Applicant submits that claims 1 and 16-19 are patentable for at least these reasons. Applicant further submits that the remaining claims are patentable at least by virtue of their dependency. Accordingly, Applicant respectfully requests that the Examiner reconsider the patentability of claims 1-19, and withdraw the rejections of claims 1-19.

IV. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Application No. 10/615,937

Attorney Docket No. Q76477

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23373
CUSTOMER NUMBER

Date: December 8, 2005